6

MAP SCALE

Objective: To review the concept of map scale, and to practice determining distances on a map using graphic and fractional scales.

Reference: McKnight and Hess, *Physical Geography*, 8th ed., pp. 31–35.

MAP SCALE

The **scale** of a map indicates how much the Earth has been reduced for reproduction on that map. In practical terms, scale is the relationship between the distance shown on a map and the actual distance that this represents on the Earth. There are two common ways to indicate the scale of a map.

Graphic Scales: The graphic scale for a map is a bar graph, graduated by distance. For example, Figure 1 shows the graphic map scales from a U.S. Geological Survey topographic map. To use a graphic scale, simply measure a distance on the map (or mark off the distance along the edge of a piece of paper), then compare the measured distance to the bar graph to determine the actual distance represented. On some graphic scales, "zero" is not at the far left. Graphic scales are useful since they remain accurate even if the map is enlarged or reduced in size.

In some cases, one graphic scale may not be accurate for all parts of the map. Some maps have several different graphic scales that are to be used for specified latitudes.

Fractional Scales: The fractional scale (also called the **representative fraction**) expresses the scale of a map as a fraction or ratio: 1/24,000 or 1:24,000.

This scale (read "one to twenty-four thousand"), says that one unit of measurement on the map represents 24,000 units of measurement on the Earth. At this scale, one centimeter on the map represents an actual distance of 24,000 centimeters on the Earth, while 1 inch on the map represents an actual distance of 24,000 inches on the Earth. Note that the units of measurement must be the same in both the numerator and the denominator.

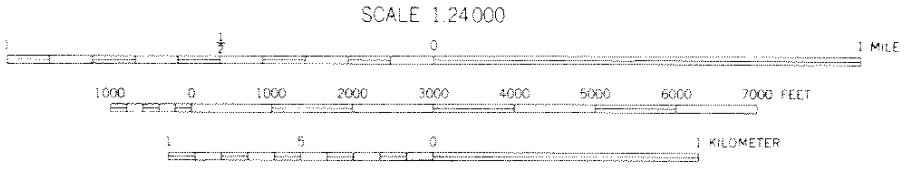


Figure 1: Graphic scales from a map with a fractional scale of 1:24,000. (From U.S. Geological Survey)

COMPUTING DISTANCES WITH FRACTIONAL SCALES

In addition to using the graphic scale, it is possible to determine distances represented on a map by using the fractional scale:

1. Use a ruler to measure the distance on the map in centimeters (or inches). This is the *measured distance*.
2. Multiply the *measured distance* by the map's fractional scale denominator. This will give you the *actual distance* in centimeters (or inches).
3. To convert your *actual distances* in centimeters (or inches) to other units, use the following formulas:

To determine the distance in **meters**:	*Actual Distance* in centimeters ÷ 100
To determine the distance in **kilometers**:	*Actual Distance* in centimeters ÷ 100,000
To determine the distance in **feet**:	*Actual Distance* in inches ÷ 12
To determine the distance in **miles**:	*Actual Distance* in inches ÷ 63,360

For example, if we have a map with a scale of 1/50,000, a measured distance of 22 centimeters on the map represents an actual distance of 1,100,000 centimeters:

$$22 \text{ cm} \times 50{,}000 = 1{,}100{,}000 \text{ cm}$$

To calculate the actual distance in meters and kilometers:

$$1{,}100{,}000 \text{ cm} \div 100 = 11{,}000 \text{ meters}$$

$$1{,}100{,}000 \text{ cm} \div 100{,}000 = 11 \text{ kilometers}$$

If we have a map with a scale of 1/24,000, a measured distance of 8.25 inches on the map represents an actual distance of 198,000 inches (8.25" × 24,000 = 198,000 inches). So:

$$198{,}000'' \div 12 = 16{,}500 \text{ feet}$$

$$198{,}000'' \div 63{,}360 = 3.1 \text{ miles}$$

LARGE VERSUS SMALL SCALE MAPS

Large scale maps refer to maps with a relatively large representative fraction (such as 1/10,000), while **small scale maps** refer to maps with a relatively small representative fraction (such as 1/1,000,000). Large scale maps show a small area of the Earth in great detail, while small scale maps show large areas in less detail.

Name _____ Section _____

PROBLEMS—PART I

For questions 1 through 4, calculate the following distances using the fractional map scale. (Your instructor may ask you to show your work in the space provided.)

1. On a map with a scale of 1:24,000, a measured distance of one inch represents an actual distance of: _____ feet

2. On a map with a scale of 1:62,500, a measured distance of 4.5 inches represents an actual distance of: _____ miles

3. On a map with a scale of 1:250,000, a measured distance of 4.5 inches represents an actual distance of: _____ miles

4. On a map with a scale of 1:50,000, a measured distance of 7.5 centimeters represents an actual distance of: _____ kilometers

5. Map T-1 (in the back of the Lab Manual) shows part of the island of Hawaii at a scale of 1:250,000. Using the appropriate graphic scale found inside the front cover of the Lab Manual, determine the distance from the "Patrol Cabin" (at the summit of Mauna Loa) to the "Rest House" (northeast of the summit of Mauna Loa):

   _____ statute miles

   _____ kilometers

6. Map T-9 shows an area near Park City, Kentucky, at a scale of 1:24,000. Using the appropriate graphic scale, determine the distance from the "Fairview Church" (in the southwest corner of the map) to the "X" marked "BM 585" along the Louisville and Nashville railway:

   _____ feet

   _____ miles

   _____ kilometers

(b) Will the graphic scales (shown above) still be usable? Why?

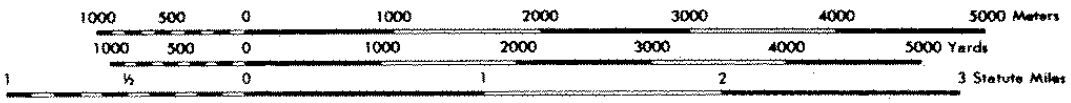
Map Scale

Name _____ Section _____

PROBLEMS—PART II

1. If a measured distance of 10 inches on a map represents an actual distance of 5 miles, what is the fractional scale of the map?

Questions 2 through 3 are based on this set of graphic scales for a map with a fractional scale of 1:50,000:



2. Why isn't "0"at the far left of the scales?

3. If a map with these graphic scales is enlarged along with the scales (such as by using a photocopy machine):

   (a) Will the fractional scale of the map change? Why?

   (b) Will the graphic scales (shown above) still be usable? Why?

T-9 Park City, KY ↑
1:24,000 (10') N

Courtesy of U.S. Geographical Society.